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## (54) COATING FILM-FORMING DEVICE AND METHOD THEREFOR

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To prevent a coating liquid applied to the surface of an object to be treated from becoming undulated by a vibration caused during conveyance by disposing successively a coating device for spreading a liquid as a coating film uniformly over the surface of the object to be treated, a vacuum drying device for drying the coating liquid applied to the surface of the object, and a heating device.

**SOLUTION:** A coating liquid for forming a coating film is dropped in the center of the surface of an object 2 to be treated which is held on a chuck 22 from a nozzle 23, and is spread uniformly over the surface of an object W to be treated by rotating the chuck 22. In this case, part of the liquid for forming a coating film intrudes around the lower face of the outer end part of the object W, but the most of the liquid is conveyed to a vacuum drying device 3 to be dried to some degree. Next, the object W is transferred onto the chuck 42 of a spinner 4 for cleaning by using a conveyance device, and then it is rotated at a high speed in a state that the object W is sucked with the chuck 42. And the coating liquid which has intruded around the lower face to be set to some degree is washed off the lower face by ejecting a cleaning liquid to the lower face. The object W is sent onto a hot plate 5 to form a coating film on the surface of the object W by heat.



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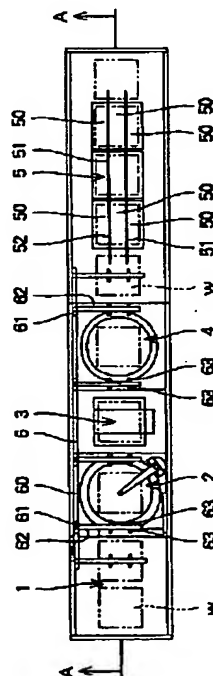
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(54) 【発明の名称】 被膜形成装置及び被膜形成方法

(57) 【要約】

【課題】 被処理物に塗布された塗布液を波打ちのない被膜とする。

【解決手段】 被処理物W表面の中央に被膜形成用の塗布液を滴下し、被処理物W表面に塗布液を均一に拡げる。この時、被処理物Wの外端部下面には被膜形成用の塗布液の一部が廻り込んでいるがそのまま減圧乾燥装置3に搬送してある程度まで乾燥せしめる。次いで、加熱乾燥をする。



## 【特許請求の範囲】

【請求項 1】 ガラス基板や半導体ウェハー等の被処理物表面に被膜を形成する装置において、この装置は被処理物の搬送ラインに沿って、上流側から下流側に向かって、被膜となる液体を被処理物表面に均一に拡げる塗布装置、被処理物表面に塗布した塗布液をある程度乾燥させる減圧乾燥装置及び加熱装置を順次配置したことを特徴とする被膜形成装置。

【請求項 2】 ガラス基板や半導体ウェハー等の被処理物表面に被膜を形成する装置において、この装置は被処理物の搬送ラインに沿って、上流側から下流側に向かって、被膜となる液体を被処理物表面に均一に拡げる塗布装置、被処理物表面に塗布した塗布液をある程度乾燥させる減圧乾燥装置、被処理物の表面から廻り込んで付着し、ある程度乾燥せしめられた余分な塗布液を除去する洗浄装置及び加熱装置を順次配置したことを特徴とする被膜形成装置。

【請求項 3】 ガラス板や半導体ウェハー等の被処理物の搬送ラインに沿って、上流側から下流側に向かって、塗布装置、減圧乾燥装置及び加熱装置を配置した被膜形成ラインによる被膜形成方法であって、この被膜形成方法は、塗布装置にて表面に塗布液が塗布された被処理物を減圧乾燥装置に送り込み、この減圧乾燥装置において、被処理物表面に塗布された塗布液をある程度乾燥せしめ、次いでこのある程度塗布液が乾燥せしめられた被処理物を加熱装置まで搬送して塗布液を被膜に形成することを特徴とする被膜形成方法。

【請求項 4】 ガラス板や半導体ウェハー等の被処理物の搬送ラインに沿って、上流側から下流側に向かって、塗布装置、減圧乾燥装置、洗浄装置及び加熱装置を配置した被膜形成ラインによる被膜形成方法であって、この被膜形成方法は、塗布装置にて表面に塗布液が塗布された被処理物を減圧乾燥装置に送り込み、この減圧乾燥装置において、被処理物表面に塗布された塗布液をある程度乾燥せしめ、次いでこのある程度塗布液が乾燥せしめられた被処理物を洗浄装置に送り込み、被処理物の表面から廻り込んで付着し、ある程度乾燥せしめられた余分な塗布液を除去し、次いで被処理物を加熱装置まで搬送して塗布液を被膜に形成することを特徴とする被膜形成方法。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】 本発明はガラス板や半導体ウェハー等の表面に各種被膜を形成する方法に関する。

## 【0002】

【従来の技術】 液晶基板として用いるガラス板にはガラス中のナトリウムが液晶に悪影響を及ぼすのを防止したり、ガラス板の屈折率を調整するため、ガラス板表面に所定の性質を有する被膜を形成している。斯かる被膜を形成するには、被処理物の表面に被膜形成用の塗布液を

滴下し、これをスピナーによって均一に拡げ、次いで加熱することで被膜とするようにしている。

【0003】 上述した従来の装置において、スピナーによって被膜形成用の液体を被処理物表面に塗布する場合、被処理物の外端部まで拡がった塗布液の一部が被処理物の裏面まで廻り込んでそのまま固まってしまう。

【0004】 斯かる不利を解消するため、従来にあってはスピナー装置と同一箇所において、被処理物の裏面に洗浄液を吹き付け、裏面まで廻り込んだ塗布液を除去するようにしている。

## 【0005】

【発明が解決しようとする課題】 しかしながら、被処理物の裏面を洗浄液によって裏面に廻り込んだ塗布液を除去しても、またすぐに表面側から塗布液が廻り込んでしまう。逆に、表面側の塗布液を完全に乾燥させ塗布液が廻り込まないようにしてから洗浄すると、洗浄に極めて長時間を要することになる。また、被処理物の表面に塗布した塗布液を全く乾燥させない状態で搬送すると、表面に塗布した塗布液が搬送の振動で波打ったり、塗布液が落下することになる。

## 【0006】

【課題を解決するための手段】 上記課題を解決すべく請求項 1 に係る被膜形成装置は、ガラス基板や半導体ウェハー等の被処理物表面に被膜を形成する装置において、この装置は被処理物の搬送ラインに沿って、上流側から下流側に向かって、被膜となる液体を被処理物表面に均一に拡げる塗布装置、被処理物表面に塗布した塗布液をある程度乾燥させる減圧乾燥装置及び加熱装置を順次配置した。

【0007】 また、請求項 2 に係る被膜形成装置は、ガラス基板や半導体ウェハー等の被処理物表面に被膜を形成する装置において、この装置は被処理物の搬送ラインに沿って、上流側から下流側に向かって、被膜となる液体を被処理物表面に均一に拡げる塗布装置、被処理物表面に塗布した塗布液をある程度乾燥させる減圧乾燥装置、被処理物の表面から廻り込んで付着し、ある程度乾燥せしめられた余分な塗布液を除去する洗浄装置及び加熱装置を順次配置した。

【0008】 また、請求項 3 に係る被膜形成方法は、ガラス板や半導体ウェハー等の被処理物の搬送ラインに沿って、上流側から下流側に向かって、塗布装置、減圧乾燥装置及び加熱装置を配置した被膜形成ラインによる被膜形成方法であって、この被膜形成方法は、塗布装置にて表面に塗布液が塗布された被処理物を減圧乾燥装置に送り込み、この減圧乾燥装置において、被処理物表面に塗布された塗布液をある程度乾燥せしめ、次いでこのある程度塗布液が乾燥せしめられた被処理物を加熱装置まで搬送して塗布液を被膜に形成するようにした。

【0009】 また、請求項 4 に係る被膜形成方法は、ガラス板や半導体ウェハー等の被処理物の搬送ラインに沿

って、上流側から下流側に向かって、塗布装置、減圧乾燥装置及び加熱装置を配置した被膜形成ラインによる被膜形成方法であって、この被膜形成方法は、塗布装置にて表面に塗布液が塗布された被処理物を減圧乾燥装置に送り込み、この減圧乾燥装置において、被処理物表面に塗布された塗布液をある程度乾燥せしめ、次いでこのある程度塗布液が乾燥せしめられた被処理物を洗浄装置に送り込み、被処理物の表面から廻り込んで付着し、ある程度乾燥せしめられた余分な塗布液を除去し、次いで被処理物を加熱装置まで搬送して塗布液を被膜に形成するようにした。

#### 【0010】

【発明の実施の形態】以下に本発明の実施の形態を添付図面に基いて説明する。ここで、図1は本発明方法の実施に用いる被膜形成装置の平面図、図2は図1のA-A線断面図である。

【0011】被膜形成装置はガラス板や半導体ウェハー等の被処理物Wの搬送ラインの一部を構成し、被処理物Wの投入部1の下流側に塗布用スピナー2を配置し、この塗布用スピナー2の下流側に減圧乾燥装置3を配置し、この減圧乾燥装置3の下流側に被処理物Wの裏面洗浄用スピナー4を配置し、更に裏面洗浄用スピナー4の下流側にホットプレート5を配置し、投入部1からホットプレート5に至るまでは搬送装置6によって被処理物Wを搬送し、ホットプレート5の部分においては搬送装置7によって被処理物Wを搬送するようにしている。

【0012】また、前記塗布用スピナー2はカップ状をなすケーシング20の中央に筒部21を設け、この筒部21に下方からモータによって回転せしめられるチャック22を挿入し、このチャック22の上方にはチャック22に吸着保持された被処理物Wの表面に被膜形成用の液体を滴下するノズル23を臨ませている。

【0013】また、前記洗浄用スピナー4はケーシング40の中央にチャック42を挿入する筒部41を設けるとともに、この筒部41の上部に洗浄液噴出ノズル43を対向して一対設けている。

【0014】一方、ホットプレート5は搬送方向に沿って3台配置され、各ホットプレート5は搬送方向と直交する方向に3分割され、各分割体50…間に隙間51を形成し、この隙間51に薄板状バー52を臨ませ、この薄板状バー52をガイドロッド53に沿って移動するシリンダユニット54に取り付けている。

【0015】而してシリンダユニット54に伸長動をなさしめることで薄板状バー52の上端がホットプレート5の隙間51から突出してホットプレート5上の被処理物Wを持ち上げ、この状態でガイドロッド53に沿ってシリンダユニット54とともに薄板状バー52を下流側へ移動し、次いでシリンダユニット54を圧縮し薄板状

バー52の上端をホットプレート5上面より下げることで、被処理物Wを下流側のホットプレート5に移し換える。このようなクランク動を繰り返すことで順次下流側のホットプレートに移し換える。

【0016】更に前記搬送装置6は被膜形成装置の一側に沿ってレール60を設けこのレール60に夫々独立して動作し得る移動体61…に係合し、この移動体61から被膜形成装置の上方に昇降自在な水平バー62を延出し、この水平バー62に支持爪63を取り付けている。

【0017】以上において被処理物Wの表面に被膜を形成する方法を以下に述べる。まず投入部1まで搬送されてきた被処理物Wを搬送装置6を用いて塗布用スピナー2のチャック22上に移載する。この場合、被処理物はその前後端下面を一對の水平バー62、62の支持爪63にて係止された状態で移される。

【0018】この後ノズル23からチャック22上に保持されている被処理物2表面の中央に被膜形成用の塗布液を滴下し、チャックを回転せしめることで被処理物W表面に塗布液を均一に拡げる。この時、被処理物Wの外端部下面には被膜形成用の液体の一部が廻り込んでいるがそのまま減圧乾燥装置3に搬送してある程度まで乾燥せしめる。

【0019】次いで搬送装置6によって被処理物を洗浄用スピナー4のチャック42上に移載し、チャック42で吸着した状態で被処理物Wを高速回転せしめるとともに下面にノズル43から洗浄液を噴出し、下面に廻り込んである程度固まった塗布液を洗い落とす。

【0020】この後、被処理物Wをホットプレート5上に送りだし、加熱によって被処理物W表面に被膜を形成する。

#### 【0021】

【発明の効果】以上に説明したように本発明によれば、被処理物表面に塗布した塗布液をある程度乾燥せしめた後に、余分な塗布液を除去したり、搬送するようにしたので、表面に塗布された塗布液が搬送の振動で波打ったり、表面に塗布した塗布液が裏面に過度に廻り込んだり、更には裏面に廻り込んだ塗布液が落下することを防止でき、しかも完全に乾燥させていないので、簡単に溶媒（洗浄液）に溶解し、裏面洗浄の時間を短縮することができる。

#### 【図面の簡単な説明】

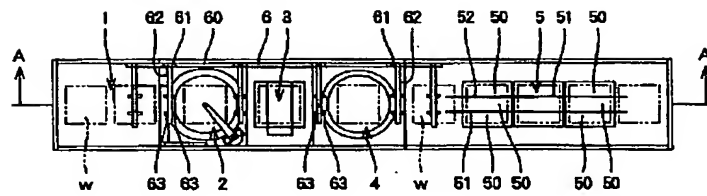
【図1】本発明方法の実施に用いる被膜形成装置の平面図

【図2】図1のA-A線断面図

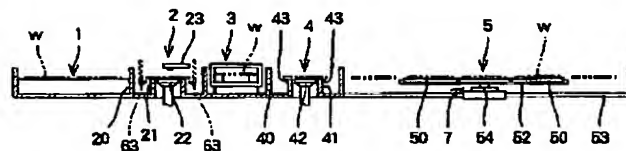
#### 【符号の説明】

2…塗布装置（塗布用スピナー）、3…減圧乾燥装置、4…洗浄装置（洗浄用スピナー）、5…ホットプレート、6、7…搬送装置、22、42…チャック、W…被処理物。

【図1】



【図2】



フロントページの続き

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## CLAIMS

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### [Claim(s)]

[Claim 1] It is coat formation equipment characterized by to carry out sequential arrangement of reduced-pressure-drying equipment and heating apparatus which dry a coater which opens to homogeneity a liquid with which this equipment serves as a coat from the upstream toward the downstream along a conveyance line of a processed material in equipment which forms a coat in processed material front faces, such as a glass substrate and a semiconductor wafer, on a processed material front face, and spreading liquid which applied to a processed material front face to some extent.

[Claim 2] In equipment which forms a coat in processed material front faces, such as a glass substrate and a semiconductor wafer This equipment goes to the downstream from the upstream along a conveyance line of a processed material. A coater which opens a liquid used as a coat to homogeneity on a processed material front face, reduced-pressure-drying equipment which dries spreading liquid which applied to a processed material front face to some extent, Coat formation equipment characterized by carrying out sequential arrangement of a washing station and heating apparatus which remove excessive spreading liquid adhered in surroundings \*\*\*\* and you

were made to dry to some extent from a front face of a processed material.

[Claim 3] It goes to the downstream from the upstream along a conveyance line of processed materials, such as a glass plate and a semiconductor wafer. It is the coat formation method by coat formation line which has arranged a coater, reduced-pressure-drying equipment, and heating apparatus. This coat formation method Send into reduced-pressure-drying equipment a processed material by which spreading liquid was applied to a front face with a coater, and it is set to this reduced-pressure-drying equipment. A coat formation method characterized by making spreading liquid applied to a processed material front face dry to some extent, and even for heating apparatus conveying this processed material spreading liquid was made to dry to some extent subsequently, and forming spreading liquid in a coat.

[Claim 4] It goes to the downstream from the upstream along a conveyance line of processed materials, such as a glass plate and a semiconductor wafer. It is the coat formation method by coat formation line which has arranged a coater, reduced-pressure-drying equipment, a washing station, and heating apparatus. This coat formation method Send into reduced-pressure-drying equipment a processed material by which spreading liquid was applied to a front face with a

coater, and it is set to this reduced-pressure-drying equipment. Make spreading liquid applied to a processed material front face dry to some extent, and, subsequently to a washing station, this processed material spreading liquid was made to dry to some extent is sent in. A coat formation method characterized by adhering in surroundings \*\*\*\*, removing excessive spreading liquid you were made to dry to some extent from a front face of a processed material, and even for heating apparatus conveying a processed material subsequently, and forming spreading liquid in a coat.

#### DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the method of forming various coats in front faces, such as a glass plate and a semiconductor wafer.

[0002]

[Description of the Prior Art] In order for the sodium in glass to prevent doing an adverse effect at liquid crystal to the glass plate used as a liquid crystal substrate or to adjust the refractive index of a glass plate, the coat which has a predetermined property is formed in a glass plate front face. In order to form this coat, the spreading liquid for coat

formation is dropped at the front face of a processed material, this is extended to homogeneity with a spinner, and it is made to consider by subsequently heating as the coat.

[0003] In the conventional equipment mentioned above, when applying the liquid for coat formation to a processed material front face with a spinner, some spreading liquid which spread to the heel of a processed material will become hard as it is in surroundings \*\*\*\* to the rear face of a processed material.

[0004] in order to cancel this disadvantage, if it is in the former, in the same part as spinner equipment, it is surroundings \*\*\*\* to blasting and a rear face about a penetrant remover at the rear face of a processed material -- he is trying to remove spreading liquid

[0005]

[Problem(s) to be Solved by the Invention] however, it is surroundings \*\*\*\* at the rear face by the penetrant remover about the rear face of a processed material -- even if it removes spreading liquid, spreading liquid keeps by surroundings \*\*\*\* from a front-face side immediately. On the contrary, as spreading liquid does not have surroundings \*\*\*\*, since, and when it dries thoroughly the spreading liquid by the side of a front face, and it washes, washing will take long duration extremely. Moreover, when the spreading liquid applied on the surface of the



processed material is conveyed in the condition of not making it completely drying, the spreading liquid applied to the front face will lenticulate by the oscillation of conveyance, or spreading liquid will fall.

[0006]

[Means for Solving the Problem] In the equipment with which the coat formation equipment applied to claim 1 that the above-mentioned technical problem should be solved forms a coat in processed material front faces, such as a glass substrate and a semiconductor wafer, this equipment carried out the sequential arrangement of reduced-pressure-drying equipment and heating apparatus which dry a coater which opens to homogeneity a liquid which serves as a coat from the upstream toward the downstream on a processed material front face, and spreading liquid which applied to a processed material front face to some extent along the conveyance line of a processed material.

[0007] Moreover, coat formation equipment concerning claim 2 is set to equipment which forms a coat in processed material front faces, such as a glass substrate and a semiconductor wafer. This equipment goes to the downstream from the upstream along a conveyance line of a processed material. It adhered in surroundings \*\*\*\* from a front face of a coater which opens a liquid used as a coat to homogeneity on a

processed material front face, reduced-pressure-drying equipment which dries spreading liquid which applied to a processed material front face to some extent, and a processed material, and sequential arrangement of a washing station and heating apparatus from which excessive spreading liquid you were made to dry to some extent is removed was carried out.

[0008] Moreover, a coat formation method concerning claim 3 meets a conveyance line of processed materials, such as a glass plate and a semiconductor wafer. It is the coat formation method by coat formation line which has arranged a coater, reduced-pressure-drying equipment, and heating apparatus toward the downstream from the upstream. This coat formation method Send into reduced-pressure-drying equipment a processed material by which spreading liquid was applied to a front face with a coater, and it is set to this reduced-pressure-drying equipment. Spreading liquid applied to a processed material front face is made to dry to some extent, subsequently even heating apparatus conveys this processed material spreading liquid was made to dry to some extent, and spreading liquid was formed in a coat.

[0009] Moreover, a coat formation method concerning claim 4 meets a conveyance line of processed materials, such as a glass plate and a semiconductor wafer. It

is the coat formation method by coat formation line which has arranged a coater, reduced-pressure-drying equipment, and heating apparatus toward the downstream from the upstream. This coat formation method Send into reduced-pressure-drying equipment a processed material by which spreading liquid was applied to a front face with a coater, and it is set to this reduced-pressure-drying equipment. Make spreading liquid applied to a processed material front face dry to some extent, and, subsequently to a washing station, this processed material spreading liquid was made to dry to some extent is sent in. It adheres in surroundings \*\*\*\*, excessive spreading liquid you were made to dry to some extent is removed from a front face of a processed material, subsequently even heating apparatus conveys a processed material, and spreading liquid was formed in a coat.

[0010]

[Embodiment of the Invention] The gestalt of operation of this invention is explained based on an accompanying drawing below. Here, the plan of the coat formation equipment which uses drawing 1 for operation of this invention method, and drawing 2 are the A-A line cross sections of drawing 1.

[0011] Coat formation equipment constitutes a part of conveyance line of the processed materials W, such as a

glass plate and a semiconductor wafer. Arrange the spinner 2 for spreading to the downstream of the charge section 1 of a processed material W, and reduced-pressure-drying equipment 3 is arranged to the downstream of this spinner 2 for spreading. The spinner 4 for rear-face washing of a processed material W is arranged to the downstream of this reduced-pressure-drying equipment 3. Furthermore, a hot plate 5 is arranged to the downstream of the spinner 4 for rear-face washing, a processed material W is conveyed by the transport device 6 until it results [ from the charge section 1 ] in a hot plate 5, and he is trying to convey a processed material W by the transport device 7 in the portion of a hot plate 5.

[0012] Moreover, said spinner 2 for spreading forms a cylinder part 21 in the center of the casing 20 which makes the shape of a cup, inserts the chuck 22 you are made to rotate by the motor from a lower part by this cylinder part 21, and is making the nozzle 23 which trickles the liquid for coat formation into a chuck 22 on the front face of the processed material W by which adsorption maintenance was carried out face above this chuck 22.

[0013] Moreover, said spinner 4 for washing countered the upper part of this cylinder part 41, and has formed one pair of penetrant remover blowout nozzle 43 in it while it forms the cylinder part 41 which inserts a chuck 42 in the center of

casing 40.

[0014] On the other hand, each hot plate 5 is trichotomized by arranging three sets along the conveyance direction in the conveyance direction and the direction which intersects perpendicularly, and a hot plate 5 is each division object 50. -- Formed the crevice 51 in between, the sheet metal-like bar 52 was made to face this crevice 51, and this sheet metal-like bar 52 is attached in the cylinder unit 54 which moves along with a guide rod 53.

[0015] The upper bed of the sheet metal-like bar 52 projects from the crevice 51 between hot plates 5 by **\*\***(ing) and making the cylinder unit 54 make extension movement, the processed material W on a hot plate 5 is lifted, the sheet metal-like bar 52 is moved to the downstream with the cylinder unit 54 along with a guide rod 53 in this condition, and a processed material W is moved and changed to the hot plate 5 of the downstream by compressing the cylinder unit 54 subsequently and lowering the upper bed of the sheet metal-like bar 52 from the hot plate 5 upper surface. It moves and changes to the hot plate of the downstream one by one by repeating such crank **\*\***.

[0016] Furthermore, said transport device 6 was engaged in mobile 61 -- which forms a rail 60 along with the 1 side of coat formation equipment, and can operate independently on this rail 60, respectively, extended the level bar 62

which can go up and down freely above coat formation equipment from this mobile 61, and has attached the support pawl 63 in this level bar 62.

[0017] How to form a coat above on the front face of a processed material W is described below. The conveyed processed material W is first transferred on the chuck 22 of the spinner 2 for spreading using a transport device 6 to the charge section 1. In this case, a processed material is moved in that order edge underside in the condition of having been stopped by the support pawl 63 of the level bars 62 and 62 of a couple.

[0018] The spreading liquid for coat formation is dropped in the center of processed material 2 front face currently held on the chuck 22 from the nozzle 23 after this, and spreading liquid is opened to homogeneity on a processed material W front face by making a chuck rotate. Although some liquids for coat formation are in the heel underside of a processed material W by surroundings **\*\*\*\***, you make it dry to the degree currently conveyed to reduced-pressure-drying equipment 3 as it is at this time.

[0019] Subsequently, a processed material is transferred on the chuck 42 of the spinner 4 for washing by the transport device 6, and while carrying out the high-speed revolution of the processed material W in the condition of having adsorbed by the chuck 42, a penetrant remover is spouted from a

nozzle 43 on the underside, and the spreading liquid which is surroundings \*\*\*\* and which became hard the grade is washed out on the underside.

[0020] Then, it is delivery on a hot plate 5 about a processed material W, and a coat is formed in a processed material W front face with heating.

[0021]

[Effect of the Invention] Since excessive spreading liquid was removed or it was made to convey according to this invention as explained above after making the spreading liquid applied to the processed material front face dry to some extent the spreading liquid which the spreading liquid applied to the front face lenticulated by the oscillation of conveyance, or was applied to the front face is surroundings \*\*\*\* too much at the rear face -- \*\* -- it is surroundings \*\*\*\* at the rear face further -- that spreading liquid falls, since it can prevent and moreover is not made to dry thoroughly It can dissolve in a solvent (penetrant remover) easily, and the time amount of rear-face washing can be shortened.

[Description of Notations]

2 [ -- 6 A hot plate, 7 / -- 22 A transport device, 42 / -- A chuck, W / -- Processed material. ] -- A coater (spinner for spreading), 3 -- Reduced-pressure-drying equipment, 4 -- A washing station (spinner for washing), 5

## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The plan of the coat formation equipment used for operation of this invention method

[Drawing 2] The A-A line cross section of drawing 1